

other than to state that the claimed methods include limitations not "originally claimed in those claims which received action the merits." As will be set forth below, this assertion fails to shoulder the burden of proof with regard to establishing that the newly submitted claims are directed to a different and distinct invention as compared to those claims elected in response to a previous restriction requirement. Accordingly, the withdrawal of claims 24-30 from consideration is traversed.

The Office Action states that newly submitted claims 24-29 and 30 are directed to inventions that are independent or distinct from the invention originally claimed. In particular, the Office states that the limitations of applying a backside gas to the topography of the substrate of claims 24-29 and the etching step of claim 30 are features not originally claimed in the elected invention of claims 1-18 and therefore, claims 24-30 are withdrawn from consideration for being directed to a non-elected invention. However, previously elected claims 1-18 and newly submitted claims 24-30 are both directed to a method for fabricating a metallization structure. In fact, newly submitted claims 24-30 incorporate limitations included within embodiments of the method taught in the Specification, from which claims 1-18 are derived. As such, newly submitted claims 24-30 are directed to the same invention as those of elected claims 1-18.

Each of the respective independent claims of claims 1-18 and 24-30, however, include differentiating limitations, making them distinct from each other. As such, the inclusion of the differentiating limitations of claim 24-30 (i.e., the application of a backside gas to the topography of the substrate in independent claim 24 and the etching step of independent claim 30) does not render the claims to be directed to distinct inventions, but rather introduces different embodiments of the same invention. Furthermore, newly submitted claims 24-30 include limitations that are taught by the specification and therefore, are included in the teachings of the elected invention. The introduction of limitations taught by the specification but not originally claimed does not restrict amendments of claims or the inclusion of additional claims detailing the same invention. Consequently, the assertion that claims 24-30 are directed to an invention not previously elected is traversed.

References Filed in Conjunction with Previous Response

In a previous response to an Office Action mailed July 12, 2001, three patents were attached as references to support the use of the term "conditions" in response to the § 112, second paragraph rejection of claims 14 and 15. As indicated in the Office Action mailed September 26, 2001, such an argument was persuasive and the § 112, second paragraph rejection was withdrawn. The Office Action further states that "[i]f the Applicant wishes to have these references considered on the record, Applicant must recite these references on a form PTO 1449 and pay the requisite fee." However, the references were merely used to support the use of the term "conditions" in claim language and were not used to refute the teachings of the presently claimed case. As such, Applicant is not submitting these references to be considered for the record. It has been requested, however, in a telephone interview with Examiner Cantelmo, that the Examiner cite the references on form PTO 892 if the Examiner deems such references to be pertinent to the teachings of the presently claimed case.

Section 103 Rejections:

Claims 1-11 and 21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,217,721 to Xu et al. (hereinafter "Xu '721") in view of U.S. Patent No. 6,176,983 to Bothra et al. (hereinafter "Bothra") and U.S. Patent 5,882,488 to Leiphart (hereinafter "Leiphart"). Claims 12-14, 16-18, 22, and 23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,270,255 to Wong ("Wong") in view of U.S. Patent 5,962,923 to Xu et al. (hereinafter "Xu '923"). Claim 15 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Wong in view of Xu '923, and in further view of U.S. Patent No 5,288,665 to Nulman (hereinafter "Nulman"). Claim 21 has been canceled rendering its rejection moot. The cited art does not teach or suggest all limitations of the currently pending claims, some distinctive limitations of which are set forth in more detail below.

To establish a *prima facie* obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP 2143.03. Obviousness cannot be established by combining or modifying the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion

or incentive to do so. *In re Bond*, 910 F. 2d 81, 834, 15 USPQ2d 1566, 1568 (Fed. Cir. 1990). Accordingly, the rejections of claims 1-18 and 21-23 are respectfully traversed.

None of the cited art teaches or suggests applying a sufficient bias power while ion metal plasma depositing a wetting layer within a cavity of a dielectric layer such that deposited metal at the bottom of cavity is splashed to the sidewalls of the cavity. Amended claim 1 recites in part:

A method for fabricating a metallization structure, comprising: ion metal plasma depositing a wetting layer within a cavity of a dielectric layer; applying a sufficient bias power to splash deposited metal at the bottom of the cavity to sidewalls of the cavity, wherein said applying occurs at least partly during said ion metal plasma depositing the wetting layer . . .

Support for such a limitation may be found, for example, on page 21, lines 1-3: "In addition, the sputtered metal ions may impact with previously deposited metal at the bottom of the trench with sufficient energy to resputter, or 'splash,' that metal onto lower cavity sidewalls 208."

None of the cited art teaches each of the limitations of the presently claimed case. In particular, neither Liephart, Wong, nor Nulman teach ion metal plasma depositing a wetting layer. In addition, Bothra, Xu '721, Wong, Xu '923, and Nulman do not teach applying a sufficient bias to splash deposited metal from the bottom of a cavity to sidewalls of the cavity while ion metal plasma depositing a wetting layer. In fact, Xu '721, Wong, Xu '923, and Nulman do not even teach applying a sufficient bias to splash deposited metal from the bottom of a cavity to sidewalls of a cavity. As such, none of the cited art independently teaches all of the limitations of claim 1.

In addition, there is motivation to combine the cited art to teach the limitations of claim 1. In particular, since Xu '721, Wong, Xu '923, and Nulman neither teach nor suggest applying a bias to splash deposited metal from a bottom of a cavity to sidewalls of the cavity, there is no motivation to combine their respective teachings to teach the limitations of claim 1.

Furthermore, although Leiphart teaches applying a bias to splash deposited metal from a bottom of a cavity to sidewalls of the cavity during a deposition of a wetting layer, the deposition of the wetting layer taught by Leiphart is not by ion metal plasma deposition

techniques as stated above. Bothra cannot cure the deficiencies of Leiphart since Bothra specifically teaches applying a bias to splash deposited metal from a bottom of a cavity to sidewalls of the cavity subsequent to the process of ion metal plasma depositing a wetting layer. "In accordance with methods of the present invention, some of the deposited process layer 48 is distributed to other areas of the semiconductor workpiece 48 following the formation of process layer 48." (Bothra -- col. 6, lines 16-20, emphasis added.) Such a specified sequence of processes implies that the application of a bias cannot be performed during ion metal plasma depositing a wetting layer. As such, there is no motivation to combine the teachings of Leiphart and Bothra with each other or the other cited art to teach the above limitation of claim 1. Consequently, claim 1 is asserted to be non-obvious and patentably distinct over the cited art.

None of the cited art teaches or suggests depositing a wetting layer consisting essentially of titanium within a cavity of a dielectric layer and depositing a first portion of a bulk metal layer upon and in contact with such a wetting layer. Amended claim 12 recites in part:

A method for fabricating a metallization structure, comprising: in a first deposition chamber, ion metal plasma depositing a wetting layer consisting essentially of titanium within a cavity in a dielectric layer above a microelectronic topography; in a second deposition chamber, sputter depositing at a first temperature a first portion of a bulk metal layer comprising aluminum upon and in contact with the wetting layer . . .

Support for such limitations may be found, for example, in Figs. 6 and 7 and in the Specification. "More preferably, wetting layer 212 is composed of relatively pure titanium (i.e., the wetting layer consists essentially of titanium) . . ." (Specification -- pg. 16, lines 22-23.) "In a preferred embodiment, first portion 214 of the bulk metal layer may be deposited above, and more preferably directly upon, wetting layer 212 both within and outside of cavity 204." (Specification -- pg. 23, lines 16-18.)

None of the cited art teaches or suggests depositing a first portion of a bulk metal layer upon and in contact with a wetting layer consisting essentially of titanium. In particular, Xu '721 and Xu '923 teach a tri-layer wetting layer with a silicided titanium bottom layer, an titanium nitride intermediate layer, and a graded titanium nitride upper layer. In some

embodiments, Xu '721 and Xu '923 teach omitting the bottom and upper layers such that the intermediate layer serves as the wetting layer. In either embodiment, the wetting layer taught by Xu '721 and Xu '923 does not consist essentially of titanium. Consequently, Xu '721 and Xu '923 do not teach the limitations of claim 12. Similarly, Wong and Nulman each teach a wetting layer comprising titanium nitride or titanium tungsten and therefore, do not teach the limitations of claim 12. Bothra and Leiphart, on the other hand, each teach depositing a wetting layer consisting essentially of titanium. However, neither Bothra nor Leiphart teach depositing a first portion of a bulk metal layer upon such a wetting layer. As such neither Bothra nor Leiphart teach the limitations of claim 12.

Furthermore, there is no motivation to combine Bothra or Leiphart with the other cited art to teach the limitations of claim 12. In particular, Leiphart teaches that "sputtering is used to deposit a refractory metal 212, such as titanium, tungsten, tantalum, and molybdenum, and to form a silicided contact." (Leiphart -- col. 5, lines 33-35.) Similar teachings are included in Xu '721 and Xu '928 in regard to the formation of the silicided titanium bottom layer. In fact, each of the cited references that teach depositing a bulk metal layer upon a wetting layer specifically teach that such a wetting layer comprise silicided titanium, titanium nitride, or titanium tungsten. Therefore, there is no motivation within the cited art to deposit a bulk metal layer directly upon wetting layer consisting essentially of titanium. Consequently, there is no motivation to combine Leiphart or Bothra with any of the other cited art without modifying the titanium layer. Alternatively stated, combining the teachings of Bothra or Leiphart with the teachings of the other cited art would result in modifying the titanium layer of Bothra or Leiphart to be a silicided titanium layer or a titanium nitride layer prior to a deposition of a bulk metal layer thereon. As such, there is no motivation within the cited art to teach or suggest the limitations of claim 12. Therefore, claim 12 is asserted to be non-obvious and patentably distinct over the cited art.

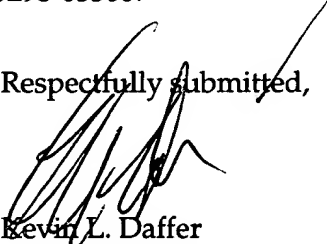
For at least the reasons set forth above, there is no teaching or suggestion within the cited art to teach the limitations of claims 1 and 12. Therefore, claims 1 and 12, and claims dependent therefrom, are asserted to be patentably distinct over the cited art. Accordingly, removal of the § 103(a) rejections of claims 1-18, 22, and 23 are respectfully requested.

CONCLUSION

In this response, claims 1, 12, and 16 have been amended and claim 21 has been canceled. The restriction of claims 24-30 and the rejections of claims 1-18 and 21-23 have been addressed. In addition, the inclusion of the references attached to the response of a previous Office Action mailed March 12, 2001 has been explained as being pertinent only to show the use of the term "conditions" in claim language and, thus, the references are not submitted as material related to the presently claimed case. Therefore, this response constitutes a complete response to all issues raised in the Office Action mailed September 26, 2001. In view of the remarks traversing the rejections, Applicants assert that pending claims 1-18 and 22-30 are in condition for allowance. If the Examiner has any questions, comments, or suggestions, the undersigned attorney earnestly requests a telephone conference.

No fees are required for filing this amendment; however, the Commissioner is authorized to charge any additional fees, which may be required, or credit any overpayment, to Conley, Rose & Tayon, P.C. Deposit Account No. 50-1505/5298-03500.

Respectfully submitted,



Kevin L. Daffer
Reg. No. 34,146
Attorney for Applicant(s)

Conley, Rose & Tayon, P.C.
P.O. Box 398
Austin, TX 78767-0398
Ph: (512) 476-1400
Date: November 26, 2001
MEH

ATTACHMENT A
"Marked-Up" Amendments

IN THE CLAIMS:

Please cancel claim 21. Please amend 1, 12, and 16 as follows:

1. (Twice Amended) A method for fabricating a metallization structure, comprising:

ion metal plasma depositing a wetting layer within a cavity of a dielectric layer;

applying a sufficient bias power to splash deposited metal at the bottom of the cavity to
sidewalls of the cavity, wherein said applying occurs at least partly during said
ion metal plasma depositing the wetting layer; and

sputter depositing, within a single chamber, substantially an entirety of a bulk metal
layer upon the wetting layer.

12. (Twice Amended) A method for fabricating a metallization structure, comprising:

in a first deposition chamber, ion metal plasma depositing a wetting layer [comprising]
consisting essentially of titanium within a cavity in a dielectric layer above a
microelectronic topography;

in a second deposition chamber, sputter depositing at a first temperature a first portion of
a bulk metal layer comprising aluminum upon and in contact with the wetting
layer [within the cavity]; subsequently

in said second deposition chamber, sputter depositing at a second temperature a second
portion of the bulk metal layer within the cavity; and subsequently

in said second deposition chamber, sputter depositing at a third temperature a third portion of the bulk metal layer upon said second portion, wherein said third temperature is lower than the second temperature.

16. (Twice Amended) The method of claim 12, wherein said sputter depositing at the second temperature further comprises depositing the second portion of the bulk metal layer upon the first portion of the bulk metal layer[, and wherein said sputter depositing at the first temperature comprises depositing the first portion of the bulk metal layer upon the wetting layer].